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Site
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Counsel in Health and Environmental Science

May 20, 1986

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GOVERNMENT DOCUMENTS

FEDERAL EXPRESS

Ms. Anne Koven
Upper Ottawa Street Landfill
Site Study Committee
20 Jackson Street West, Suite 412
Hamilton, Ontario L8P 1L2

Dear Anne:

Enclosed please find a copy of the feasibility study performed by ENVIRON to determine whether a risk assessment analysis could be conducted in an attempt to correlate past air emissions from the Upper Ottawa Street Landfill and the future risk of long term chronic disease (cancer). I again apologize for the delay in providing you with this report. I hope you will find that it clearly and concisely explains what we attempted to do and why we halted the project after Phase One was completed. If you have any questions or comments regarding this document, please feel free to call me.

ENVIRON has been pleased to provide assistance to the Upper Ottawa Street Landfill Study Comittee; and I, personally, have enjoyed working with you, Dr. Bourns, and others. The team of people (you, Clyde, Joel, etc.) who worked on the health related issues were not only technically capable, but truly pleasurable to work with. I sincerely appreciate the opportunity I had to work on this project.

I have reviewed the invoices which we discussed on the telephone, and I will be calling shortly to clarify what the bills were for. I look forward to seeing you at the time of the public meeting when the Committee's report is presented and I hope that sometime, when I am in Toronto for OWMC or another client, we will have a chance to get together, perhaps for a drink or dinner.

Sincerely,

Joseph H. Highland, Ph.D.
Principal

JHH:ej
enclosure

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ENVIRON Corporation
Counsel in Health and Environmental Science

UPPER OTTAWA STREET
LANDFILL RISK ASSESSMENT - FEASIBILITY STUDY

Prepared for

Upper Ottawa Street
Landfill Study Committee

Prepared by

ENVIRON Corporation
Washington, DC and Princeton, NJ

May 20, 1986

210 Carnegie Center, Suite 201
Princeton, New Jersey 08540 · (609) 452-9000

UPPER OTTAWA STREET LANDFILL RISK ASSESSMENT - FEASIBILITY STUDY

1. INTRODUCTION

The Upper Ottawa Street Landfill located in Hamilton, Ontario, Canada, began accepting both liquid and solid municipal and industrial wastes for disposal in the late 1940s. In 1977, the Ministry of Environment (MOE) instituted a waybill system regulating the transportation and deposition of industrial wastes in landfills. As a result of suspected misuse and falsification of waybills by several industrial contributors, investigations of the landfill site for possible health hazards to area residents began in 1978.

Health studies of both the workers from the site and the neighboring residents were conducted (see Chapters __ and__,). The results of the health studies (see Chapter __) showed an increased incidence of particular symptoms in the populations studied relative to control populations. The symptomology for the neighboring residents was found to be consistent with that experienced for the site workers and apparently related to chemical exposures from the landfill.

Given these findings, a logical next step was to determine if a correlation could be developed between air emissions associated with site operations and possible long-term cancer risk. Limited monitoring data exist for the site, so that characterization of air emissions can only be undertaken by a process of estimation based on available data on waste characteristics, available monitoring data, etc. The purpose of this study, therefore, was to assess the feasibility of such an estimation approach and to determine if a correlation study between air emissions and long-term cancer risk was possible.

The feasibility study was designed to be undertaken in the following steps:

Step 1 Review data on waste characteristics and site operating procedures.

Step 2 Make approximations of emission rates, atmospheric dispersion, human dose, and risk for selected chemicals.

Step 3 Refine estimates of emission rates, atmospheric dispersion, human dose, and risk for selected chemicals.

At the end of each step, provision was made for review of the results before proceeding further. Subject to the satisfactory conclusion of Step 3 and the availability of data, the risk assessment would then be extended to address the range of chemicals present at the site. In practice, the study was concluded at the end of Step 1 because of the lack of data.

2. CRITERIA FOR EVALUATION OF FEASIBILITY

Before describing the methodology used in Step 1 of the study, it is instructive to explain the criteria by which the overall feasibility of risk assessment would be assessed. The following key criteria were identified:

- Estimation of emission rates must be possible for a substantial portion of the volatile species and particulates present at the site.
- The potential health impacts associated with the estimated emissions must be consistent with the symptomology observed in the health studies.

Only if these criteria were met would there appear to be any potential for establishing a linkage between air emissions from the site and long-term health risk.

. METHODOLOGY

The objective of Step 1 was to review all available waste characterization and environmental sampling data for the Upper Ottawa Street Landfill to identify any systematic patterns for chemicals found at the site that would constitute the basis for the modeling of air emissions. Five sources of emission from the site were identified as potential contributors to health risk:

- The open landfill cells;
- The inactive landfill cells;
- Wood burning on the site;
- The solidification/chemical treatment operations; and
- Off-site access roads.

Of these sources of emission, it was recognized that data for wood burning at the site and the off-site access road were not likely to be available and that these sources would therefore have to be excluded *a priori* from any analysis. To assist in characterizing emissions for the remaining sources, two types of data were reviewed: environmental sampling data and waste characteristic information.

Environmental Sampling

Chemical studies at the landfill have been conducted on air, surface water, groundwater, and leachate emitting from the site. Of these, four specific types of environmental sampling data were considered to be applicable for the modeling of air emissions:

- Air and landfill gas,
- Landfill leachate,
- Landfill cover material, and
- Soil.

These are displayed in Table 1. Of these data, perhaps the most relevant to the study are the air and landfill gas samples collected by Conestoga-Rovers Associates in October, 1982. These results show acetone, methyl ethyl ketone, toluene, xylene, hexanone, and 1,4-dioxane present at high concentrations. Sampling performed in 1981 indicated much lower concentrations were present. While some of these compounds were also found in the landfill leachate, there was no clear correlation either in terms of the dominant chemicals or in terms of temporal distribution.

Waste Characteristics

The second type of data reviewed were waste characteristics of the material deposited at the site. While the Upper Ottawa Street Landfill Site Study Committee has investigated information on the waste type and waste quantities deposited in the landfill, there is no accurate or complete record of the types or amounts of waste that were placed there. The information available on the landfill quantities consists of records by the City of Hamilton (1960s and 1970s) of traffic entering the site, a liquid waste summary recording system instituted in 1975 by the Region of Halton, and a waybill system operated by the Ontario Ministry of the Environment for which data are available for a four-month period in 1979. We note, however, that the waybill system was designed to identify the waste quantity, type of waste being transported, and final disposal location, but does not provide adequate documentation on chemical constituents of the wastes. A summary of available waste characteristics data is presented in Tables 2 and 3 based on the above sources. Also, data on the composition of the steel wastes used as cover material at the site are shown in Table 4.

In general, the data are incomplete and represent only a small fraction of the waste materials deposited at the Upper Ottawa Landfill site. Furthermore, there appears to be no readily discernible correlation between the chemicals found in the materials deposited at the site (as shown in Tables 2, 3, and 4) and the environmental sampling data in Table 1. Similarly, the data do not permit any quantitative estimation of concentrations for chemicals in the landfill. The only exception to this was for polynuclear aromatic hydrocarbons (PAHs), which are constituents of the steel waste cover material used at the site. From 1976 to 1980, steel wastes were used as daily cover and, from November 1980 to June 1981, approximately 340 thousand tons were placed on the landfill as final cover. The breakdown of the composition of steel waste and cover utilized on the site in 1981 is shown below:

Composition	Percentage
Blast furnace oxides	38.0%
Steel making oxides	37.0%
Steel making metallic slag fines	19.0%
Hot mill filtration plant oxides	3.5%
Cold mill water treatment plant filter cake	0.5%
Evacuated clean fill	0.8%
Miscellaneous sources such as road grinding, lime sludge, tank cleanouts, and floor sweepings	1.5%

While the landfill was active, the daily operating practice was to compact the garbage at the end of each day and cover it with six inches of steel industry waste the following day; a working area was typically 8 feet high and 50 feet long. This practice was followed from 1976 to 1980 and used an estimated 2.2 million tons of steel industry waste. This steel waste was similar to the waste used in the cover material,

except it also included foundry sand which comprised 7 to 13% of the cover material. Relatively complete waste composition data are available for these materials.

4. DATA ANALYSIS

Review of available data from environmental sampling and waste characteristics provides a limited understanding of the air emissions associated with the site operations. The only materials for which there are sufficient data to model quantitatively air emissions are the PAHs generated by the placement of steel wastes cover material. Data for volatile organic chemicals in environmental samples and wastes deposited at the site do not show an consistent pattern sufficient to characterize air emissions.

While modeling of PAH emissions appears technically feasible, we do to believe that this would be merited for the following reasons:

- PAH emissions would account for only a small component of the overall air emissions from the site, so that the associated health risk would not be considered representative of the site as a whole.
- The health effects associated with PAH exposure are not consistent with the pattern of symptoms observed in the health studies.

5. CONCLUSIONS

Based on the above analysis, it was concluded that the characterization of long-term human health risk (risk of cancer) resulting from air emissions from the Upper Ottawa Street Landfill would not be feasible due to deficiencies in available data on emissions, waste characteristics and site operating procedures.

TABLE 1

Air Sampling Results[1,2,3]

	Concentration (ppm)							
				Air and Vent Sampling[2]*** 1981-82)				
	Flare Gas Vents[1]*		Landfill Gas[2]**					
Compound	10/20/82	10/21/82		Gooseneck	Quanset	Firehall	Upwind	Downwind
Acetone	608	547	--	0.010	ND	ND	0.020	ND
Methyl ethyl ketone	154	92	--	--	--	--	--	--
C2-benzene	--	--	88	--	--	--	--	--
Toluene	256	245	102	0.062	0.021	0.002	0.004	0.029
Ethyl benzene	81	71	--	0.005	0.001	ND	ND	0.005
o-xylene	192	184	--	0.029	0.005	0.001	0.002	0.005
m-xylene	84	86	--	--	--	--	--	--
Hexanone	90	58	--	--	--	--	--	--

Leachate Analysis[3,4,5,8]

	Concentration (ppm)								
	Site 324-8								
Compound	7/83	3/84	10/84	12/84	H20+Leachate[3]	Site 15[8]	Site 11[8]	Site 12[8]	Site 18**[8]
Acetone	1.002	ND	ND	ND	--	BRQL	D	0.007	0.032
Tetrahydrofuran	1.213	1.549	2.457	3.70	0.150	0.024	D	0.343	0.330
Dichloromethane	0.222	0.0188	21.8	11.7	--	ND	ND	BRQL	BRQL
1,4-dioxane	18.66	0.949	6.74	16.7	--	0.027	D	1.951	4.926
Phenylpropanoic acid	--	--	--	--	--	1.110	ND	--	--
Ethylbenzenebutanoic acid	--	--	--	--	--	0.880	ND	--	--
Terpineol	--	--	--	--	--	0.839	--	--	--
1-1-dimethylbenzyl alcohol	--	--	--	--	--	0.890	0.184	--	--

FOOTNOTES

[1] Conestoga-Rovers & Associates Feasibility Study: Landfill Gas Control.
[2] Upper Ottawa Street Landfill Study Committee Interim Report, May 31, 1983.
[3] Memo to Dr. Bourns, etc., re: Chemical Inventory Research, November 30, 1982. (MOE, sampling 4179).
[4] Mann Testing Laboratories, Monitoring of Leachate and Redhill Creek, #1, September, 1983.
[5] Mann Testing Laboratories, Monitorin gof Leachate and Redhill Creek, #2, October, 1984.
[6] Mann Testing Laboratories, Chemical Analysis of Core Soil Samples from BH #2 and BH #4, 1982.
[7] Memo to Committee, from Anne Koven, October 4, 1982.
[8] UOLs Study Committee, The Investigation of the Upper Ottawa Street Landfill Site, November 6, 1985, Draft.

ND - Not Detected
BRQL - Below Reliable Quantification Level
D - Detected but Amount Not Determined

TABLE 2

Data Generated by UOL Research

Generator Waste Type	Quantity	Constituents	Comments
			Major generators and haulers in region were contacted for inventory, 1978-9
M & T Chemicals			
Organic Solvents	1,000 gal/m	Ketone Toluene Xylene PVC resins (13% solids)	Letter from K&D, 7/20/78, estimated receives 11,000 gal/m
Chromic acid	700 gal/m	6% hexavalent chromium Trace chlorides fluorides sulphates Mainly water	
Wallace Barner Co. Ltd. Petroleum solvent (varsol 3139)	50 gal/m	Aliphatic hydrocarbons, aromatic hydrocarbons, contaminated with automative baking enamels	
	300 gal/m	Trichloroethylene with quenching oil	

NA - Not Available

TABLE 2

Data Generated by UOL Research (continued)

Generator Waste Type	Quantity	Constituents		Comments
Allen Industries				
Black carbon (plastisol)	18,000 lb/wk	Vinyl paste resin	10.16%	
		Carbon black	0.18	
		Barium sulphate	72.41	
		Calcium oxide	0.58	
		Di-isodecophthalate	13.49	
		Hydrogen solvent	3.04	
		Interstol-761-28	0.14	
		Barium nonyl phenate		
		Cadmium actoate		
		Zinc actoate		
		Phenyl phosphate		
		Hydrocarbon solvent		
Paint scrap/lacquer solvent mixture	300 gal/m	Nitrocellulose lacquer thinner		
Chemical Engineering Dept.	75-250 gal/yr	Waste organic and inorganic liquids		
P.K. Enterprises	NA	1/3 oil remainder water		
Interflow	50% sent to landfill	Scrubber waste	60%	Material in lagoon at Pier 24
		organic portion	2%	
		water	80%	
		Latex waste	25%	
		organic portion	4%	
		water	91.7%	
		Acid rinse water	15%	
		Halogenated hydrocarbons		Region reprimand

NA - Not Available

TABLE 2

Data Generated by UOL Research (continued)

Generator Waste Type	Quantity	Constituents	Comments
Interflow (cont'd)	5,000 tons	Liquid wastes: halogenated aliphatics halogenated aromatics acrylated and latex emissions plasticizers, resins, elastomer, carbon tetrachloride trichloroethylene, oils, oil sludges, esters, ethers	1975-78, received from Eastman Kodak at landfill or solid/stab. facility
	800 tons	Base solutions: pH 12, iron manganese, magmesium, resins, salts, mercaptans	1975-77, received from Hooker
Canadian Curtis Refrigeration	315 gallons	Plastic dissolvent in methyl chloride	Reprimand
Currie Products Ltd.	4 barrels	Liquid waste w/ high phenolic content	Vacated property 5/97; Region suggested new owners send material to Tricil or Frontenac
	114,000 gals	Napthalene	
	38,500 gals	Tar residues	
	100 gals	Diesel fuel	
Canadian Urethane	90 gals	Chlorinated hydrocarbon	
Inglis Co.	1,440 gals	Material w/ trace/high xylene	
Canadian Methane	NA	Trichloroethane waste	Detected in waste during analysis
Stelco	200 gals	% chlorinated paraffin in lubricant oil	

NA - Not Available

TABLE 2

Data Generated by UOL Research (continued)

Generator Waste Type	Quantity	Constituents		Comments
WABCO Ltd.	1,300 gals	Waste w/halogenated hydrocarbons		Uses xylene and freon TF in process, but according to company, not buried with waste
MOE Waybill	317,155	Acids	43 %	4 month period 8/79-11/79
	148,994	Alkalais	17	
	10,400	Metal finishing waste	1	
	172,645	Other inorganics	20	
	27,300	Oily water	3	
	7,500	Waste oil	0.87	
	10,050	Organic solvents	1	
	900	Plastic resins	0.10	
	20,200	Other organics	2	
	2,500	Paint pigments	0.29	
	87,540	Inert sludges	10	
Canadian Pittsburgh Paints	NA	Paint sludge		Following information is Provincial Liberal Party research office
Eastman Kodak	NA	Acetone Methanol Isopropyl alcohol Hexane Xylene		
Beacon Atomic Stock Spray	NA	Piperonyl butoxide d-trans allethrin Thiocyano acetate Technical isobornyl		

TABLE 2

Data Generated by UOL Research (continued)

Generator Waste Type	Quantity	Constituents	Comments
Identification Compounds Sent to Landfill:			
Alkaline solutions		Solvents, heavy metals	
Caustic solutions		Lead	
Inorganic sludges		Copper, zinc, lead	
		Water, crude & mineral oils	
		Epoxy resin monomer	
		Amine or amide	
		Zinc sulphate	
		Phenol	
		Iron, zinc hydroxides	
		Gasoline, kerosene	
		Xylene, acetone, ammonia	
		Styrene	
		Coal tar	
		Sewage scum	
		SO_2	
		Lime slurry	
		Amyl acetate	
		Enamel slurry and point	
		Vitreous spirits	
		Sulfite solutions	
		Halogenated hydrocarbons	
		Carbon black	
		Varsol	
Other Wastes		PCBs	
		Cyanide sludges	
		Toluene	
		Ethyl benzene	
		Pyridine	
		1,2-dichloroethane	
		Benzene	
		Chloroform	
		Motor oil	
		Battery acid	
		Paints	
		Paint thinners	
		Radioactive Wastes	

TABLE 2

Data Generated by UOL Research (continued)

Generator Waste Type	Quantity	Constituents	Comments
Other Wastes (cont'd)	100-300 drums	Cyanide sludes	Disposed of 1974-77
		Benzene	
		Toluene	
		Assorted solvents	
		Paint sludges	
	4,500 gals	PCBs	
		Xylene	
		Isopropyl alcohol	
		Methanol	
		Hexane	
		Vitavax mixture of sodium sulphate and sodium chloride	
	100,000 gals. in 1 week	Isocyanate drums	

TABLE 3

Hazardous Waste Generated in Hamilton Region

Generator Waste Type	Quantity	Constituents	Comments
			A Waste Quantities Study documented hazardous waste generation, quantity, etc. in Ontario 1981
Organic sludges and still bottoms (no oil)	1,700 Solid-153 Liquid & sludge-1,557	Organic sludges containing metals Halogenated still bottoms Non-halogenated still bottoms	Landfarm/incineration solid, prior to secure landfill
Solvents and organic solutions	1,900	Halogenated/non-halogenated mixed	Incineration
Oils and greases	1,700	Waste lube oil, other oils	P/C, incineration, landfarm
Oil/water mixtures	4,000	Emulsified and free oil/ water mixtures	P/C, incineration, landfarm, solid prior secure landfill
Organic and oily residuals	36,200 Solid-2,896 Liquid & sludge-3,304	Leaded gasoline, unleaded gasoline	Incineration, landfarm, secure landfill
Heavy metal solutions and residuals	94,800	Spent plating or etching, rinse, and less concentrated aqueous solutions, sludges from plating and etching lines, sludes from treatment of solutions containing metals	P/C, solid, prior secure landfill

TABLE 3

Hazardous Waste Generated in Hamilton Region-(continued)

Generator Waste Type	Quantity	Constituents	Comments
Misc. chemicals and products	20,600 Solid-19,158 Liquid & sludge-1,442	Organic chemicals, inorganic chemicals, salts	Incineration, packed for secure landfill
Paint and organic residuals	2,400 Solid-552 Liquid & sludge-1,848	Latex paint & sludge, solvent based paint & sludge, wash & rinse waters, adhesives, and glue	Incineration, ash fixed prior to secure landfill
Aqueous solutions with organics (90% water)	<100	Alcohols and organic acids, halogenated solvents, non-halogenated solvents	Biological, to sewer
Anion Complexes	16,800	Cyanide, sulfide, other complexes	P/C, biological, solid, landfill
Sludges and inorganic residuals	109,600 Solid-85,488 Liquid & sludge-24,112	Ash, spent catalyst, foundry sand containing phenols	Solid prior to secure landfill
Pesticide & herbicide wastes	<100 Solids	High concentration organics, high concentration with metals, cleanup water, and dilute solutions	Biological, incineration
PCB wastes	N/A	High concentration liquids (>500 ppm), medium concentration liquids (<500 ppm) contaminated soil (<50 ppm)	Liquid incineration

TABLE 3

Hazardous Waste Generated in Hamilton Region-(continued)

Generator Waste Type	Quantity	Constituents	Comments
Cleanup residuals	300 Solids	Solvent and organic waste, inorganic and metals, pesticides, and herbicides	Sanitary landfill, secure landfill
TOTAL	290,000 Tonnes =	36,310,600 gals of liquids & sludges*; 108,647 tons of solid wastes	

*Assumes that weight of liquid waste is close to that of water - 200 imperial gallons are equivalent to 1 tonne.

TABLE 4

PAH Concentrations

PAHs in Cover Material[1] (1981)

Steel Wastes	Concentrations in Cover Material (ppm)					
	Blast Furnace Oxides	Steel-making Oxides	Steel-making Slag Fines	Filtration Plant Oxides	Cold Mill Filter Coke	Foundry Sands
Composition of Top Cover	38%	37%	19%	3.5%	0.5%	(7-13%)
Phenanthrene	2.13	13.26	0.34	1.94	5.4	0.83
Methyl phenanthrene	5.72	1.70	0.37	6.79	ND	ND
Fluoranthene	4.78	33.26	BRQL	0.93	0.80	ND
Pyrene	4.78	24.19	BRQL	0.74	1.06	ND
Chrysene	1.96	24.25	BRQL	0.18	ND	ND
Dimethyl naphthalene	0.60	BRQL	ND	0.69	6.40	BRQL
Trimethyl naphthalene	7.28	0.39	BRQL	1.01	ND	BRQL
Acenaphthylene	BRQL	0.40	ND	ND	5.80	ND
Ideno(1,2,3-CD)pyrene	ND	8.03	ND	BRQL	1.46	ND

Soil Samples[2] (1982)

	Compounds Detected in Boring (ppm)					
	Borehole #2				Borehole #4	
Composition of Top Cover	25'	45'	55'	65'	55'	80'
Phenanthrene	6.3	9.6	3.6	8.5	24.3	13.5
Fluoranthene	3.0	5.0	2.2	4.0	22.5	7.8
Pyrene	4.5	6.3	2.5	6.2	23.5	9.0
Chrysene	0.7	1.6	0.7	1.1	9.5	2.9
Anthracene	0.6	0.9	0.5	0.7	5.6	1.2
Benzo(a)pyrene/isomers	0.6	2.0	1.1	1.5	7.3	2.4
Naphthalene	5.6	1.0	0.4	0.3	32.8	9.5

PAHs in Sediments[3] (1985)

	Concentrations (ppm)				
Compound	Site 2	Site 22	Site 8	Site 12	Site 32
Methyl phenanthrene	2.83	10.88	1.71	6.49	13.57
Fluoranthene	4.43	1.46	1.04	BRQL	BRQL

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[1] Memo to Dr. Bournes,etc., re: Chemical Inventory Research, November 30, 1982. (MOE, sampling 4179).

[2] Mann Testing Laboratories, Chemical Analysis of Core Samples from BH #2 and BH#4, 1982.

[3] UOLs Study Committee, The Investigation of the Upper Ottawa Street Landfill Site, November 6, 1985, Draft.

ND - Not Detected
BRQL - Below Reliable Quantification Level

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